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First Records of the Pteropods *Clio scheelei* (Munthe, 1888) and *Clio andreae* (Boas, 1886) (Opisthobranchia: Thecosomata) from the Western Pacific Ocean

by

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Abstract. Single individuals of *Clio andreae* (=*C. polita*), taken in three oblique plankton hauls from depths to 1000 m in the Coral Sea and Solomon Sea, are described and figured. This is the first published record of the species from the Pacific Ocean. Three individuals of *Clio scheelei* similarly taken from depths to 2000 m in the Coral Sea are also described and figured. This species was previously known from a single individual captured off Patagonia.

INTRODUCTION

Thecosomatous pteropods are found in all oceans, being most diverse in tropical waters and mainly epipelagic in distribution (BÉ & GILMER, 1977). There have been few studies of pteropods from waters off northeastern Australia other than those arising from the "Siboga" (TESCH, 1904) and "Challenger" (PELSENEER, 1888) expeditions, and from the studies of RUSSELL & COLEMAN (1935), TESCH (1948), TANAKA (1970), and SOLIS & WESTERNHAGEN (1978).

The present study arose from an examination of plankton samples taken from depths in excess of 1000 m in waters of the Coral Sea off northeastern Australia, and of the Solomon Sea to the north of Australia. Amongst the pteropods taken from those samples were two rare bathypelagic forms, neither of which has previously been recorded from the western Pacific Ocean, and one of which was previously known only from a single specimen taken in the southeastern Pacific. The present paper describes and illustrates western Pacific specimens of *Clio scheelei* (Munthe, 1888) and *Clio andreae* (Boas, 1886), extending greatly the known distribution ranges of both.

MATERIALS AND METHODS

All specimens were taken from plankton samples collected from the Solomon Sea and Coral Sea in 1981–1982, primarily for ichthyoplankton studies. Tows were made with nets of 4.0-mm mesh through the water column from depths greater than 1000 m to the surface. Samples were preserved in 2–3% formalin and deposited in the Museum of Victoria, Melbourne. Pteropods from those samples were made available for the present study and all specimens examined are lodged in the Museum of Victoria. Measurements were made with the aid of Wild M5 and M20 microscopes. Surface features were photographed using scanning electron microscopy (SEM). Thecate hydroids attached to the protoconchs of both *Clio andrea* and *C. scheelei* were not removed from our specimens prior to SEM treatment because of the extremely delicate nature of the shells. Thecate hydroids also have been found attached to other thecosome species (MILLARD, 1975). Only one of the three available specimens of each species was subjected to SEM treatment (and consequent damage). The best specimens were examined and drawn, but retained intact for museum deposition. Radulae were extracted from the specimens prior to the shell being subjected to SEM. The radula and buccal tissue were left in 10% KOH for 24 h, stained in acid fuchsin and prepared for light microscopy. Drawings were made with the aid of a camera lucida.

Sample data and species occurrences are given in Table 1.

RESULTS AND DISCUSSION

Clio andreae (Boas, 1886) (=*C. polita* Pelseener, 1888)

Single specimens of *Clio andreae* were taken in samples from depths to greater than 1000 m at two stations in the

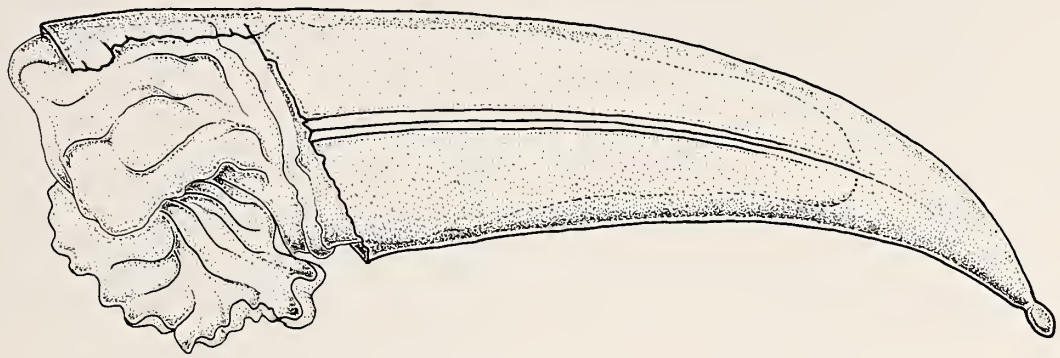

Figure 1

Clio andreae, lateral view of shell specimen that measured 7.3 mm long, aperture width 3.4 mm maximum.

Coral Sea and one station in the Solomon Sea (see Table 1). The animals were intact but their shells were damaged. All three specimens have been deposited in the Museum of Victoria (reference No. F 53081–53083).

All our specimens showed good agreement with shell features described by VAN DER SPOEL (1967, 1976) for specimens of up to 14 mm in length and 7 mm in width. The shell is transparent, fragile and colorless, and the shape is long and slender. The surface is completely smooth and without striae, but there is a protrusively rounded lateral rib on each side (Figure 3D). These ribs extend to the aperture rim, and are most prominent in the anterior half of the body, diminishing more posteriorly and being indiscernable in the posterior quarter (Figures 1, 3A–C). The shell has a distinct dorsal curvature, this curvature being more pronounced in the posterior third; the ventral border is therefore convex. The protoconch is not uniformly rounded distally, having an oval shape with an obtusely pointed distal end. The radula has 10 rows of teeth, which is typical of the genus, the teeth being similar in shape to those described for this species by VAN DER SPOEL (1967).

Clio andreae is known to be bathypelagic, occurring in depths below 1000 m. Populations are known to occur in tropical, subtropical, and transitional waters of the North and South Atlantic (VAN DER SPOEL, 1967, 1976). The only previous record of this species from the Pacific Ocean is contained in an unpublished report by MCGOWAN (1960, see BÉ & GILMER, 1977) who reported it from a depth of 135–250 m in the Gulf of Panama.

Clio scheelei (Munthe, 1888)

Single specimens were found in each of three samples collected from the Coral Sea (see Table 1). In each case the samples were taken by oblique hauls from a maximum depth of approximately 2000 m. All three specimens were found with the animal intact although some shell damage was evident. All three specimens are deposited in the Museum of Victoria (reference No. F 53084–53086).

The shell is transparent, straight and slender, with the surface annulated by equally spaced transverse lirations (Figures 2, 3E–G). A lateral rib extends on each side from the aperture rim to the protoconch; these ribs have a distinct

Table 1

Sample and shell data for occurrences of *Clio andreae* and *C. scheelei*.

Species & date	Sample no.	Latitude	Longitude	Max. tow depth (m)	Time		Shell dimensions (mm ± 0.1)	
					Start	Finish	Length	Aperture width
C. andreae								
18 May 81	1007-3	6°40.1′S	150°32.8′E	?	0010	?	12.6	5.1
1 Dec. 81	1043-5	12°21′S	146°30′E	1000	0105	0600	13.6	7.0
2 Dec. 81	1046-8	12°38′S	148°55′E	1450	1740	2355	7.3	3.4 (SEM)
C. scheelei								
2 Dec. 81	1046-8	12°38′S	148°55′E	1450	1740	2355	Specimen damaged	
3 Dec. 81	1047-7	12°31′S	148°41′E	1650	0015	0635	8.9	4.3
4 Dec. 81	1049-8	13°50′S	148°18′E	2100	2400	0624	7.0	3.4 (SEM)

SEM indicates these specimens as photographed in Figure 3.

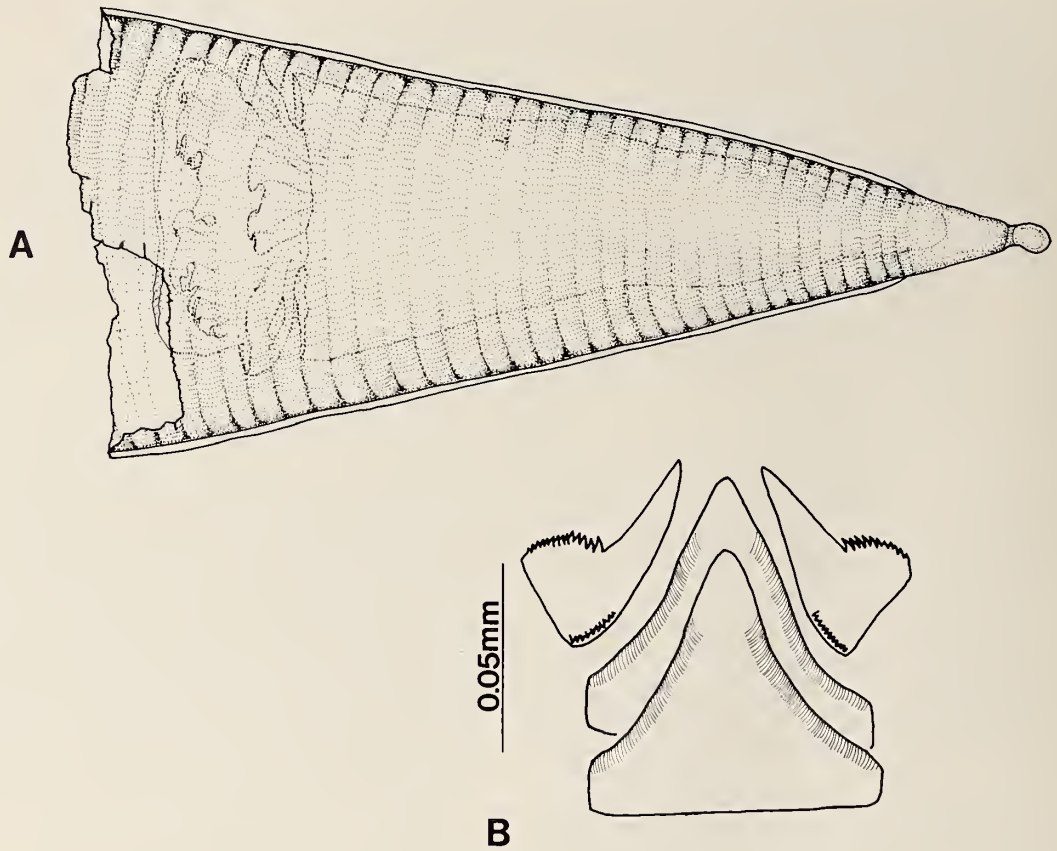

Figure 2

A. *Clio scheelei,* dorsal view of shell specimen that measured 7.0 mm long, 3.3 mm aperture width. B. Portion of radula showing median and marginal teeth.

median longitudinal indentation making them "gutter-shaped" (Figure 3F, H). The protoconch is rounded and separated from the teleoconch by a pronounced constriction.

The radula is composed of 10 rows of teeth. The lateral teeth show spines on both margins and the median tooth is bluntly pointed with fine serrations (Figure 2B).

Only one specimen of *Clio scheelei* has previously been reported in the literature, and that was collected off the coast of Patagonia (148°0'S, 77°0'W) near Cape Horn (MUNTHE, 1888). This holotype cannot be located (van der Spoel, personal communication). Munthe described his specimen of *C. scheelei* as having a distinctive, broad longitudinal "ridge" widening towards the aperture. The dorsal side of the shell was also described as having three convex longitudinal ridges, the middle one being most pronounced, but not being present on the posterior portion of the shell. These broad ridges could not be discerned in our Coral Sea specimens. However, because Munthe's specimen was considerably larger than ours (being 16 mm in shell length), it is possible that our specimens are at a younger growth stage and that the formation of longitudinal "ridges" only becomes evident as greater size is achieved. In all other respects, our specimens agree with MUNTHE's (1888) original description of *C. scheelei* in: having a straight shell shape; being dorsoventrally flattened; having uniformly spaced transverse lirations; and in having a distinct groove running lengthwise down the center of the lateral ribs. Our specimens are therefore attributed to that species.

Clio scheelei differs from all other *Clio* species in having

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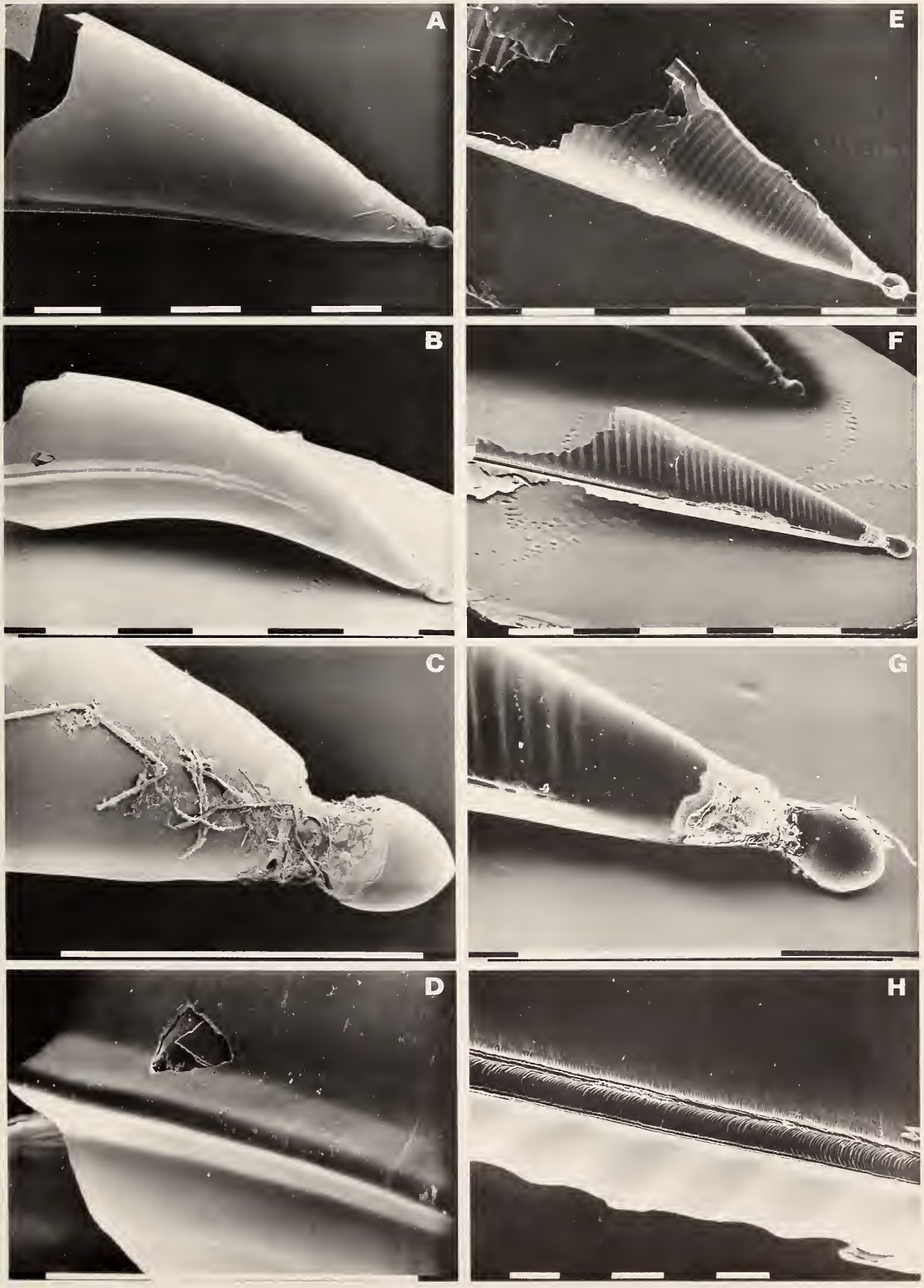
Figure 3

A–D, shell of *Clio andreae*: A, ventral view; B, lateral view; C, protoconch detail; D, detail of rounded lateral rib. E–H, shell of *Clio scheelei* shell (damaged during SEM preparation): E, ventral view; F, lateral view; G, protoconch detail; H, detail of indented lateral rib. Scale bars = 1 mm.


A
E
B
F
C
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D
H

a combination of the following shell characteristics: a straight shell with a 2:1 length-to-width ratio, a distinct constriction separating the protoconch and teleoconch, and transverse surface liration. The only two species of *Clio* that show any close similarity to *C. scheelei* are *C. recurva* (Childern, 1823) and *C. orthotheca* (Tesch, 1948). TESCH (1913) illustrated differences in shell shape between *C. scheelei* and *C. recurva*. The shell of the latter is curved ventrally at the posterior end, and its protoconch lacks a constriction. *Clio orthotheca* has a shell that is straight in shape, but does not have the distinctive liration as found in *C. scheelei*. The only known record of *C. orthotheca* is from the Indian Ocean (TESCH, 1948).

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